are enclosed in square brackets. A fresh account of the genus Hieracium has been drawn up by Miss R. F. Thompson and included in the book. A conspectus of the groups and species from the "Handbook of British Rubi," by the Rev. W. Moyle Rogers, has, by permission, been added as an appendix.

Since its publication in 1894, Preston's "Theory of Heat" has been regarded as a standard work on the subject. Teachers and students will welcome the new edition which has just been published by Messrs. Macmillan and Co., Ltd. The revision, necessary in view of the recent progress made in this branch of physics, has been done by Mr. J. Rogerson Cotter, of the University of Dublin. Among the changes in the new edition may be mentioned the transference of the section on the dynamical equivalent of heat from chapter viii. to chapter iv., a few unimportant omissions, and the addition of some hundred pages of new matter. The additions have been enclosed in brackets. Mr. Cotter has succeeded in bringing the book well up to date, and in this way has ensured a continued popularity for an excellent treatise.

An interesting and simple mechanical model devised for the purpose of illustrating to students the gas laws and the nature of Carnot's cycle is described by Dr. F. B. Kenrick in the May number of the *Journal of Physical Chemistry*.

We have received a copy of the *Chemikalien-Zeitung*, a new journal to be published fortnightly under the editorship of Dr. R. Pauli, Berlin. The journal will be devoted to matters relating to the manufacture and application of chemical substances in the industries. One of the chief objects of the promoters is to produce by means of the fortnightly publication a work of encyclopædic character dealing with this aspect of technical chemistry.

We have received vol. i., No. 1, of the *Memoirs* of the College of Science and Engineering, Kyoto Imperial University, a publication containing original papers by members of the university. Among other papers worthy of notice are "Synthesis of Indigo and its Methyl Derivatives," by M. Kuhara and M. Chikashigi, and "Defects of Uncarburetted Water Gas as Fuel for Laboratory Use," by M. Chikashigi and H. Matsumoto.

In the *Physikalische Zeitschrift* (No. 12, 1904), Messrs. Elster and Geitel describe a new form of electroscopic apparatus for the investigation of feebly radio-active bodies. With this a large number of different kinds of earths, minerals, lavas, and water deposits has been examined. The activity of the sedimentary deposits from the hot springs at Baden-Baden is remarkably high, the sludge deposited at the source having approximately the same activity as uranyl potassium sulphate. As the distance of the deposited matter from the source increases, its activity falls off rapidly.

Some recent experiments by M. Henriet communicated in the *Comptes rendus* (vol. cxxxviii. p. 1272, 1904) show that formaldehyde is present in considerable quantity in the atmosphere. The method of estimation consists in aspirating the air through a tube containing red oxide of mercury heated to 250°, in which the formaldehyde is oxidised to carbonic acid, which is then absorbed in potash bulbs. The carbonic acid already present in the original air has to be subtracted from the amount thus found, and the difference corresponds to formaldehyde. In 100 cubic metres of normal air formaldehyde is present to the extent of 2-6 grams.

In view of the high atomic weight of radium and the remarkable ionising properties of the salts, it would not have been surprising if the electrolytic properties of radium bromide had been altogether abnormal. That this is not the case is clearly shown by the recent measurements of Kohlrausch and Henning, published in the *Verhandlung* of the German Physical Society (vol. v. pp. 144-6, March 15). The electrical conductivity is perfectly normal over the range from N/20 to N/12,000, and closely resembles that of the corresponding barium salt. The molecular conductivity rises from 100·0 to 123·6 over this range of dilution, and the limiting value is given as 125. The mobility of the radium ion is therefore 57 as compared with 56 for barium, and 53 for strontium and calcium. It is of interest to note that Runge and Precht's value for the atomic weight would give an altogether abnormal value, 67, for the ionic mobility.

We find in the *Bulletin* of the Society of Naturalists of St. Petersburg (1904, No. 3) an interesting paper, by N. Karakash, based on a recent journey of A. Zhuravskiy and on previous exploration, giving some idea about the little known eastern portion of the tundras of Arkhangelsk, which is known as the Bolshezemelsk tundra, and lies between the Petchora and the northern Urals and the Pai-hoi Range. This portion of the tundra has not the flat and marshy character which it has in the west, but it is covered with mounds, hills, and narrow low ridges of Boulder-clay, reaching a height of 100 and occasionally 200 feet, and a length of from 12 to 20 miles. Between these mounds and hills are found countless lakes, marshes, and spaces which can be described as true patches of the tundra. All these hills are undoubtedly of morainic origin, the Boulder-clay having only been washed by water on its surface and covered here and there with sand. As to the boulders, they consist of granites, porphyrites, gneisses, and various metamorphic slates, as also of limestones and sandstones. The latter contain Devonian, Carboniferous, and Carbo-Permian fossils, such as are well known from the western slopes of the Urals, as also Permian and Jurassic fossils, such as are known further south in the basin of the Petchora. Traces of a post-Glacial sea have only been found near the shores, but it is known from the previous researches of Barbot-de-Marny, Tchernysheff and others that large spaces of north-eastern Russia, up to a level of about 120 metres, were covered by the sea during the post-Glacial period.

OUR ASTRONOMICAL COLUMN.

Radial Velocity of the Orion Nebula.—From the measurement of a series of spectrograms of the three brighter stars in the trapezium of Orion, Messrs. Frost and Adams have determined the radial velocity of those parts of the nebula located by these stars. Seven plates of the star θ^1 Orionis (October, 1903, to February, 1904) gave a mean velocity for the nebula of +19·3 km., three plates (December, 1903, January and February, 1904) of the star Bond 640 gave 18·0 km., and one plate (March 8, 1903) of the Bond star 619 gave +14 km. The general mean was +18·5 km., which is slightly higher than the values obtained by previous observers, *e.g.* +17·7 km. obtained by Keeler in 1890-91. Surprise is expressed as to the low value determined for the last named star, as the plate measured was an exceptionally good one, but the observers hesitate to draw conclusions from the results obtained from one plate.

The radial velocities of the stars themselves were also determined from the dark-line spectra on the same plates, and the provisional values are given for the two Bond stars. Regarding θ^1, the peculiarities of the spectrum and the binary character of the star will necessitate the study of a much greater number of plates before definite values can be obtained. For Bond 640 a mean value of +20 km. was determined, whilst for Bond 619 a value of +48 km., strikingly greater than that of the nebula, was obtained.

The same observers also publish the results of similar

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observations of four stars of the Orion type (9 Camelopardi, κ Cancri, μ Sagittarii, and δ^1 Lyræ) which have variable radial velocities (*Astrophysical Journal,* No. 5, vol. xix.).

MASS AND SHAPE OF JUPITER.—At the June meeting of the Royal Astronomical Society, Mr. Bryan Cookson read a paper giving the results of a series of heliometer observations of Jupiter's satellites made by him at the Cape Observatory during 1901–2.

Within two months of the opposition of the planet he made 783 observations of the satellites in distance and position angle. The values obtained for the mass were

$$1 : 1047{\cdot}69 \pm 0{\cdot}09 \text{ and } 1 : 1047{\cdot}66 \pm 0{\cdot}06$$

during 1901 and 1902 respectively. These agree very well *inter se*, but differ considerably from Prof. Newcomb's adopted value of 1 : 1047·35, a difference which has yet to be explained or eliminated.

The value for the compression-constant of the planet was also different from the adopted value, being 11 per cent. greater. As determined in the paper, the ellipticity is 1 : 15·8, but direct measurements of the equatorial and polar diameters gave 1 : 16·5. Part of this difference may be real, but part may be due to the difficulty experienced in measuring the planet's diameter (*Observatory*, No. 346).

"REVERSALS" IN SUN-SPOT SPECTRA.—In a paper appearing in No. 5, vol. xix., of the *Astrophysical Journal,* Mr. W. M. Mitchell, of the Princeton (N.J.) Observatory, publishes the results of four sets of observations, made during March and April with a Rowland grating spectroscope (20,000 lines) attached to the 23-inch refractor of the Halsted Observatory, of the lines reversed in sun-spot spectra in the region λ 6770 to λ 4915. The number of lines more or less affected in this region was more than 270, and Mr. Mitchell gives a table containing about 70 lines which were found reversed, and 6 lines which were thinned. In the region C–D about 35 per cent. of the lines affected were seen reversed, whilst for a further 5 per cent. the appearance of reversal was too uncertain to give definite results. The C line was observed partially reversed on April 8, but the *b*, E, and D groups were never affected. D_3 was not seen at all.

ESCAPE OF GASES FROM THE EARTH'S ATMOSPHERE.—In a communication to the *Philosophical Magazine* (June, 1904) Dr. Johnstone Stoney directs attention to a recent letter from Mr. S. R. Cook, published in NATURE (March 24), on the "Escape of Gases from Atmospheres." After stating that he arrived at the same conclusion as Mr. Cook, by the same methods, thirty or forty years ago, and has since had to abandon that conclusion, Dr. Stoney shows that the flow of helium from springs into the earth's atmosphere is from 3000 to 6000 times more than can be accounted for by the minute quantity dissolved by the rain in falling, yet the relative quantity of helium in the atmosphere apparently remains constant. Therefore, he says, helium *is* escaping from the atmosphere, the rate of escape being equal to that of the influx. Further, Dr. Stoney also shows that theoretically the conditions under which the flights of gaseous molecules take place in the upper atmosphere sufficiently explain the outflow, as it would only be necessary for the chance of escape for each molecule to occur once in several days in order to account for the amount received by the atmosphere from the earth.

FORTHCOMING RETURN OF ENCKE'S COMET.—In No. 6, vol. i., of *Knowledge and Illustrated Scientific News,* Mr. Denning publishes a few notes in reference to the return of Encke's comet during the coming autumn. Due at perihelion on January 4, it should be observable in large telescopes about August or September, and will be nearest the earth, at a distance of about 35,000,000 miles, in the third week in November. On October 4 it will apparently be about half-way between β Andromedæ and α Trianguli, thence, travelling westward, it will arrive at about 5° N.E. of β Pegasi on November 1.

The present period, according to Prof. Seagrave, is about 1206d. 20·25h., and during the coming apparition the favourable conditions of 1805, 1838, and 1871 (period 33 years) should be repeated. It is possible that early in December, when close to Altair, the comet may be visible to the naked eye.

THE UPPER CHALK OF ENGLAND AND ITS ZONES.

WE have received two important contributions to our knowledge of the Upper Chalk in this country. The one on "The Upper Chalk of England" is the third and concluding volume of Mr. Jukes-Browne's memoir on the Cretaceous rocks of Britain, issued by the Geological Survey (price 10*s*.). It is a goodly volume of 566 pages, in which the stratigraphical features of the Upper Chalk and the fossils of the successive zones are very fully dealt with. As in previous volumes, Mr. William Hill has contributed particulars of the microscopic structure of the Chalk. The ample topographical and palæontological descriptions of the Chalk will enable the student readily to ascertain what is known, and the author has been fortunate in being able to embody the results of a great part of the recent work accomplished by Dr. Rowe. In one chapter he discusses the bathymetrical conditions during the formation of the Upper Chalk, pointing to facts presented by the Chalk rock-beds which indicate a general upheaval of the British area. Later on, during the period of the Micraster and Marsupite zones, evidence of subsidence is afforded, and this was probably succeeded by re-elevation during the time of the Belemnitella zone. This volume contains a general account of the economic products of the Chalk, including water-supply, and reference is made to the bournes or nail-bournes, notable examples of which, as at Croydon and elsewhere, have recently manifested themselves. The Chalk escarpments and other features of Chalk districts are described. There is also a general list of all the known fossils from the Chalk of England, with references to zones and localities, and there is a full bibliography. Mr. Jukes-Browne is to be congratulated on the completion of this exhaustive work. We only wish that it had been somewhat better illustrated.

Turning to the other work, "The Zones of the White Chalk of the English Coast, part iv., Yorkshire," by Dr. Arthur W. Rowe, we find a work of a little more than a hundred pages, with twenty-two beautiful photographic plates and other illustrations, issued by the Geologists' Association (vol. xviii., part iv., price 3*s*.).

The previous portions of Dr. Rowe's work on the zones in Kent and Sussex, in Dorset and in Devon, have been already noticed in NATURE. The present part is the result of "42 days of steady work" on the cliff-sections and adjacent chalk-pits of the coast near Flamborough Head. The time seems limited (as the author observes), but as he went fortified with the accumulated knowledge and experience of many years' assiduous study, and was accompanied, as before, by Mr. C. D. Sherborn, he was ready and able to make the fullest use of his time. When he refers to the region as "a veritable *terra incognita*" we can hardly agree with him, despite his own saving clauses. But that he has enriched our knowledge to a very large extent, as he invariably does, was inevitable, and all geologists will rejoice.

The essay itself fills the reader with enthusiasm, for it is written with vigour and with a heartiness that is contagious. The work proved less easy, though not less interesting, than was anticipated. The record of the fauna was found to constitute "a veritable zoological romance."

It was "wholly impossible to institute any valid comparison between this marvellous coast and any of the sections which we had previously described." The variations in the distribution and range of the species, the rarity of zonal guide-fossils, the hardness of the rocks, to say nothing of the difficulties of getting at the strata, were alike remarkable. At the same time the results of Dr. Rowe's work afford "overwhelming proof of the validity and homogeneity of the zonal theory," and we cordially commend the work to all students. In an appendix Mr. G. W. Lamplugh contributes some notes on the conditions of accumulation of the Yorkshire Chalk, and refers to the finding of an ammonite, 3 feet in diameter, beneath which was an agglomeration of small fossils, evidently protected from decay by the huge ammonite. He remarks that a considerable portion of the Chalk was probably due to the pulping-down of calcareous bodies by lowly organic agencies. Referring back to Mr. Jukes-Browne's volume

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